

pressure sensor alone is the sensing element, in the trivial case where one uses a stylus, such as is done in the use of PDAs currently available in the market place called "Palm-tops" (made by 3Com, Hewlett Packard, Casio, Philips, etc.) the sensing and interpretation is easy. These devices utilize a distributed or wide area logical pressure sensor which provides a logical YES output for a selected positional area. These preceding devices do not work with fingers reliably since the keycaps are too small.

[0121] In the present invention, since there is a certain amount of shared "real estate" due to clustering, the user is intentionally allowed to press part of an adjacent key (principally the primary key while pressing a secondary key. Many approaches to the determination of the location of X and Y coordinates of a touch point based on sensing pressure are well known. A pressure sensitive input device comprising an X-coordinate detection resistive element connected to mutually parallel vertical conductors and a Y-coordinate detection resistive element connected to mutually parallel horizontal conductors, for detecting the position of a point depressed by a stylus or the like, works by detecting changes in the resistance values of these resistive elements.

[0122] The present invention utilizes either a distributed or wide, area logical pressure sensor alone which provides a logical YES output for a selected positional area, or a low threshold central pressure sensor in combination with other detected readings such as an applied pressure, rate of applied pressure, or shadowing. Switches are used for on-off control of the current flowing into or out of both ends of the X-coordinate detection resistive element and the Y-coordinate detection resistive element, and a voltage detection circuit detects the voltage between the X-coordinate detection resistive element and the Y-coordinate detection resistive element. Multiple inputs can be detected based on the results from the voltage detection circuit when the currents are switched by the switches.

[0123] The preceding is but one approach to pressure sensing based location determination known in the art. A more sensitive "smart sensor" type micro-strain gage based localized point sensor located at the midpoint of the keycaps of the primary keys and at the midpoint of the secondary keycaps (the midpoints are mildly textured to facilitate tactile feedback without optical degradation), located along the circumference of a circle which constitutes the "virtual circle" along which lie the locus of the centers of the secondary keys of the various electronic arrangements. This sensitive pressure sensor can output an analog pressure level and its digitized digital equivalent and likewise the rate of change of pressure and its digitized equivalent. The sensor is a smart sensor in that it can be embedded in the carrier material.

[0124] The first level of mutual exclusivity is rather trivial. The system logic will not accept inputs from two different cluster keys; such dual activation attempt will occur when a user inadvertently presses two adjacent secondary keys belonging to two different clusters (the system will output an error message and sound a beep asking the user to move the finger a little closer to the center of the cluster). It can also occur when one purposely tests the system by pressing keys from clusters that are not adjacent (this will merely elicit a beep and optional error message). Once the finger is operating within a cluster, the finger perhaps overlaps a little over

let us say 3 keys . . . The intended secondary key (let us say the alphabet B), the corner of the primary key (which is the number 2) and a portion of the adjacent secondary key (say the letter A) . . . under these circumstances, the pressure sensor that is distributed over the entire "keycap" areas of both the secondary keys and the primary key will generate a logical YES for these keys. However, the more sensitive pressure sensor located in the middle (lower threshold), will in most instances have an output only in the intended secondary key of B. This output in reality has two components, an analog level (or its digitized equivalent) representing the amount of or relative amount of pressure (this is likely to be the highest in the intended secondary key since presumably the finger tip is acting on it. For further reliability, a rate input will also be generated in identical fashion. When uniqueness is established the logical outputs from the other two keys are precluded from proceeding further. A simple implementation would accomplish this inside the box with conventional electronics. It is also possible to implement this in solid state or monolithic way by opening the conductive pathway from the non intended keys thus making it mutually exclusive. It is noted that a second pressure sensor, i.e., the generalized pressure sensor also needs to be there for another case, i.e. when one attempts to provide a very clean input by using a pen tip or stylus as is done on Palmtops these days. Of course they are doing it because the current art is deficient in that it provides no choice of finger actuation because the keycaps are based on the emulation of QWERTY type keys which are tiny.

[0125] However, the pressure sensing area is mostly in a restricted smaller area around the center. The centers of the adjacent keys are located far enough apart that they result in one or more different levels of pressure generated by a pressing finger. The key associated with the higher level is selected as representing the fingertip which better represents the intended key. In the embodiment with the solar cell, the pressing of a key generates both an analog signal representing the amount of shadowing of a key cap by a operating finger and a digital/logical output which are used in preprocessing singly or in combination with the outputs from the pressure sensor. One approach involves picking for comparison of the shadowing levels only those keys whose pressure sensors have generated a logical YES and simultaneously picking for comparison of the pressure levels only those keys whose shadowing has generated a logical YES. In this scheme of preprocessing, at any stage upon identifying a reliable output such as by the use of a logical AND of the pressure and shadow/solar cell sensors further processing is stopped. The early and reliable identification of an input precludes the activation or consideration of another input in this mutually exclusive electronic cluster key arrangement.

[0126] It is to be understood that the present invention is not limited to the embodiments described above, but encompasses any and all embodiments within the scope of the following claims.

I claim:

1. A cluster key arrangement comprising:

a cluster key means including a primary key means and at least one secondary key means; and,

switching means enabling a user to select said primary key means or said at least one secondary key means in a mutually exclusive manner.